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AN INSTANCE OF INSECT DAMAGE RESULTING FROM ZERO-MARGIN SELECTIVE CUTTING OF PONDEROSA PINE

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A sample cutting area for the study of the application of selective logging to ponderosa pine was established near Greenough, Montana by the Northern Rocky Mountain Forest and Range Experiment Station in November 1932. This area, which contained 18.25 acres, was subdivided into three contiguous plots each being cut under a different method of marking. Plot 601 (4.05 acres) was clear cut according to current practice. This procedure resulted in the removal of 94 percent of the total volume of ponderosa pine and 70 percent of the Douglas fir in trees 14 inches d.b.h. and larger. The rather light residual stand was composed of small Douglas fir trees(13 inches d.b.h. and smaller) and a normal quantity of tops and cull logs on the ground.

Plot 602 (6.87 acres) was cut by the zero-margin selection system of marking. Under this method only those logs from trees whose lumber-selling value exceeded their production cost were removed. As in many instances only butt logs were removed, an abnormal quantity of cull logs and large tops resulted.

1/ Cooperating with the Northern Rocky Mountain Forest and Range Experiment Station of the Forest Service.

Plot 603 (7.33 acres) was cut according to optimum silvicultural practice which left a stand of ponderosa pine amounting to only 60 percent of the volume remaining on the zero-margin (plot 602) area. As there was no economic selection of logs, the volume of residual wood on the ground after logging was materially less than that on the clear-cut plot.

The method of slash disposal was the same for the three areas, the slash being piled and burned. Large tops and logs rejected because of defect and negative value were not treated in the slash-disposal operation.

Description of Trees in Study

Classification of all trees on the zero-margin plot as to vigor, crown, and dominance, as assigned by forest officers at the time of cutting, is shown in table 1.

Table 1.--Classification of ponderosa pine trees on zero-margin plot

	Trees	Vigor			Shape of crown 1/			Position of crown 2/			
		Good	Fair	Poor	P	R	F	D	C	I	S
	No.	Percent			Percent			Percent			
Cut	72	15	49	36	15	50	35	72	24	3	1
Not cut	237	14	52	34	33	41	26	11	36	30	23
Died since cutting	67	9	43	48	28	40	32	8	34	31	27
Alive October 1936	170	15	56	29	36	41	23	12	37	29	22

1/ P - pointed, R - round, F - flat.
2/ D - dominant, C - codominant, I - intermediate, S - suppressed.

It will be noted from the preceding data that the trees selected for cutting did not show any great difference in vigor from the residual stand except that they comprised most of the older and taller individuals, as indicated by the greater number of round and flat tops as well as dominant positions. It will also be seen that the trees living at the time of the 1936 examination were of better vigor than those killed. This same relation is also shown in both crown classification and degree of dominance, as flat-topped and suppressed trees are in most cases less thrifty than those with pointed crowns or in dominant positions. Though the average vitality of the killed trees was undoubtedly less than that of the trees still living at the time of the examination, the cause of death is believed to be directly attributable to insect attack.

Loss From Insect Attack

Examinations to ascertain insect losses were made by the writer in July 1935 and October 1936. The data obtained during the 1935 examination showed that subsequent to the cutting of the timber there had been a light ponderosa pine loss in the residual stand of the silvicultural plot, a very heavy loss on the zero-margin area, and, of course, a negligible loss on the clear-cut plot as only a very light stand of ponderosa pine (6 percent of the total volume) had been left. These were for the most part young trees with a high resistance to insect attack.

The economic marking on the zero-margin plot left 246 ponderosa pines above 6 inches d.b.h. Since 7 of these were broken by logging and 2 harbored primary attacks of bark beetles at the time of marking, the actual residual stand was 237 trees. The loss prior to July 1935 amounted to 27 percent of the total number, or 64 trees. As the dead trees were somewhat smaller than most of the trees in the residual stand, this loss represented approximately 20 percent of the total volume. The examination in October 1936 added 3 more dead or dying trees to the loss on the zero-margin plot, which increased the total to 28 percent, or 67 trees.

Of the dead trees 4 had been killed by primary attacks of Dendroctonus brevicomis Lec., 1 by D. monticolae Hopk., and the remainder by attacks of Ips. oregoni (Eich.) and I. emarginatus (Lec.) in the tops, accompanied by a sour-sap condition below the point of attack. A sour or fermented sap in the lower bole is caused by an excess of moisture associated with a cessation of transpiration due to destruction of foliage. This condition often follows severe defoliation by insects or, as in this case, top killing by beetles which included the entire crown. A few of the dead trees had light attacks of the red turpentine beetle, D. valens Lec., which may have made them more susceptible to attacks of secondary beetles. In the sour-sap portion of the boles there were scattered attacks of Hylurgops rugipennis (Mann.), which were purely secondary.

Abundant Host Material Causes Insect Attack

The most logical reason for the heavy loss in the residual stand of the zero-margin area, as compared with the loss in the surrounding general region, is the susceptibility of the trees to insect attack and the attraction of secondary beetles to the heavy accumulation of large tops and cull and other logs of negative value due to the economic selection of logs. This is not an unusual condition as ponderosa pine slash under certain conditions is a potential source of danger to adjacent trees. A broken tree top or a windfall is often the medium through which a number of trees are subsequently killed by secondary bark beetles. The severity

of such damage often depends on the quantity of fresh slash as well as the conditions under which it is formed. There are several species of Ips beetles which are attracted to and breed in material of this character and which upon emergence, if additional slash and logging debris are not available, will attack and kill young trees or the tops of larger ones. At times these beetles are attracted to a locality by freshly cut slash, but attack adjacent standing trees.

During the early part of the 1933 season the rejected logs and large tops on the zero-margin plot were attacked by Ips beetles, and a large percentage of the trees that died subsequently were top-killed by these insects in the fall of that year. A number of the top-killed trees were re-attacked the following season. The second attack was confined to the upper part of the bole below the top-killed portion, and this in most cases completed the destruction of the crown. There were 6 top-killing attacks in 1934 and 2 in 1935. Though the evidence of this series of attacks still remained at the time of the examination, no attempt is made in this paper to establish an interrelationship of the different broods, though naturally its existence is assumed.

Conclusions

Infestations by so-called secondary bark beetles are in most cases short-lived and usually follow sporadic wood cuttings or logging operations. The position of the writer relative to the danger of ponderosa pine slash as a medium through which destructive outbreaks of bark beetles may develop is based upon present methods of operation and not upon conditions associated with a zero-margin or economic selection of logs. An annual accumulation of large tops and cull logs, comparable to conditions on the zero-margin plot, creates a situation with which the workers of the forest insect laboratory at Coeur d'Alene, Idaho have had no experience. Such methods of cutting are a marked departure from former practices, and the entomological danger of such steps should be recognized.

Though the loss of trees on this small area illustrates what happened in one instance, experience will not permit the acceptance of such a few data as a predication of the damage that will be associated with an intensive application of zero-margin selective logging. It is true that the results of this small experiment are not conducive to the adoption of this type of cutting as a large percentage of the expected second cut has already been destroyed. However, if there is merit in this method it should not be discarded for entomological reasons until a thorough study has demonstrated the degree of danger as well as the impossibility of modifying its application to avoid the present criticism.